



NORTH CAROLINA Department of Transportation



Transportation Resiliency Delivers Results

NCDOT's Response & Recovery to Hurricane Florence

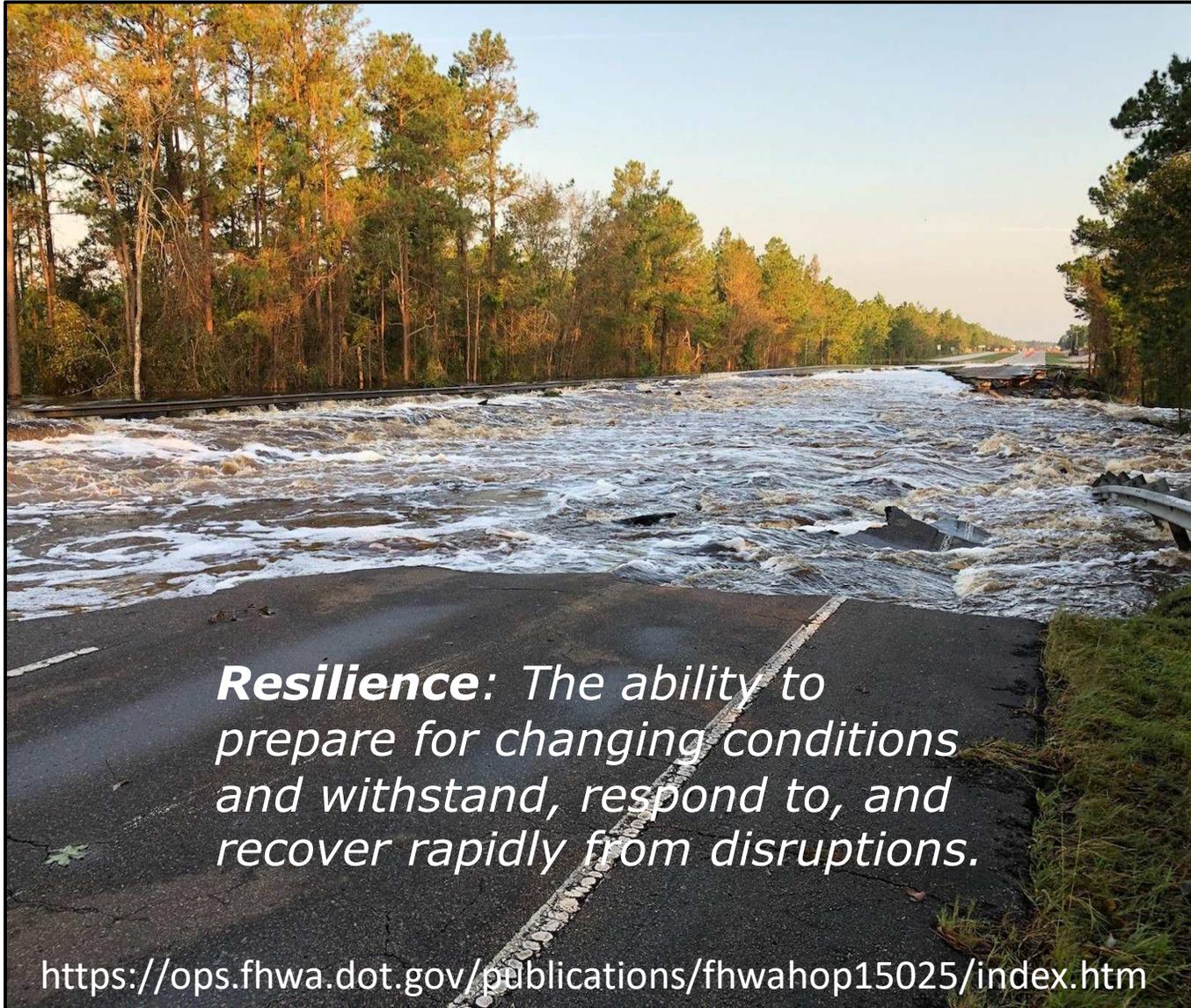
2019 TRC Transportation Conference & Equipment Expo

Joshua Kellen, PE

Training & Development/Disaster Recovery Engineer

June 5, 2019

Resiliency

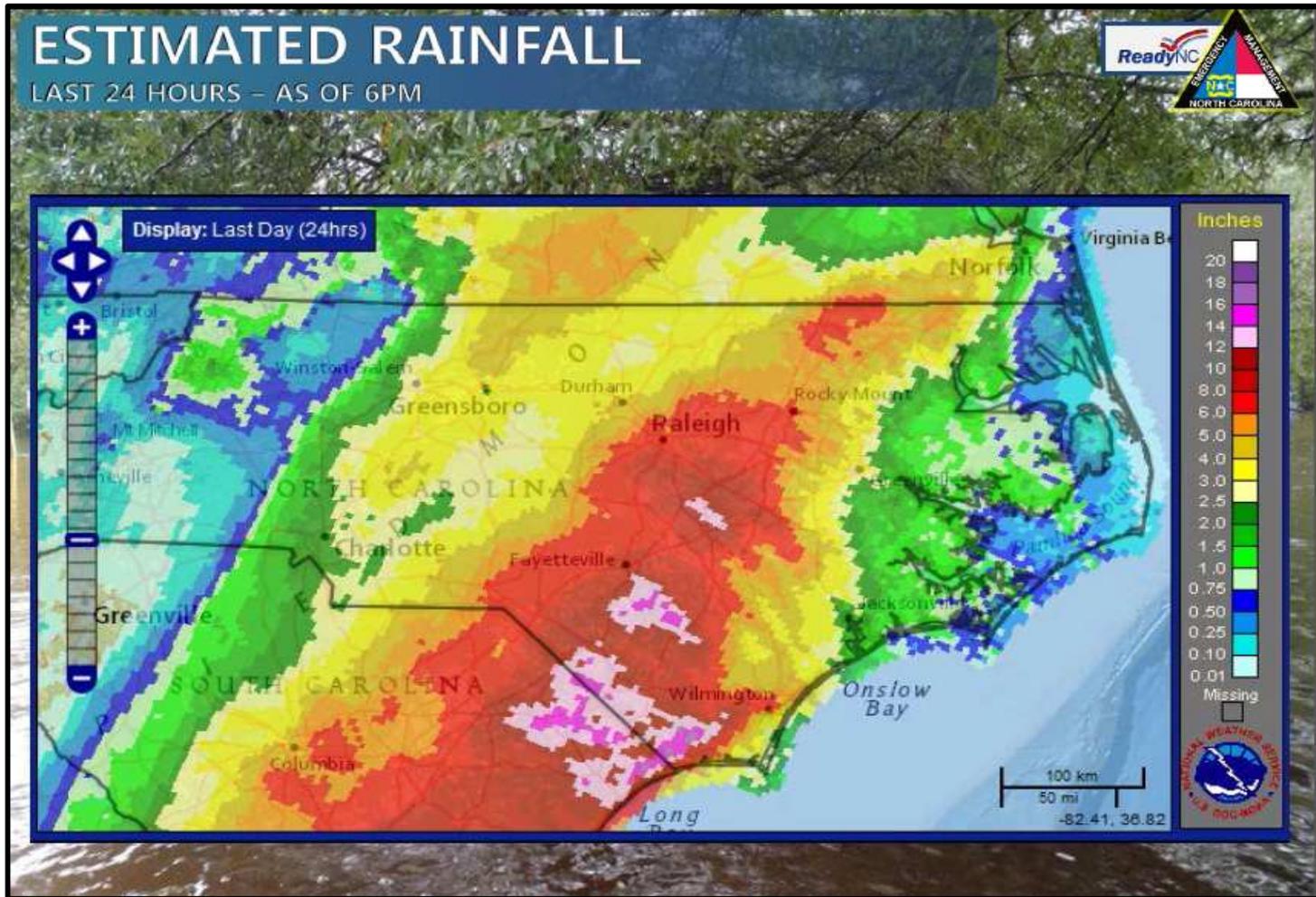


Resilience: *The ability to prepare for changing conditions and withstand, respond to, and recover rapidly from disruptions.*

<https://ops.fhwa.dot.gov/publications/fhwahop15025/index.htm>

Experience

Hurricane Matthew (October 2016)



RAINFALL REPORTS

HURRICANE MATTHEW

Valid Sunday, October 09, 2016 (1:30 PM)



Location	Rainfall
White Oak (Bladen)	16.71"
Goldsboro (Wayne)	15.24"
Hope Mills (Cumberland)	14.71"
Chadbourn (Columbus)	12.90"
Lumberton (Robeson)	12.47"
Elm City (Nash)	11.95"
Edenton (Chowan)	11.88"
Windsor (Bertie)	11.07"
Point Harbor (Currituck)	10.73"
Easons Crossroads (Gates)	10.60"
Garner (Johnston)	10.22"

Experience

Hurricane Matthew (October 2016)



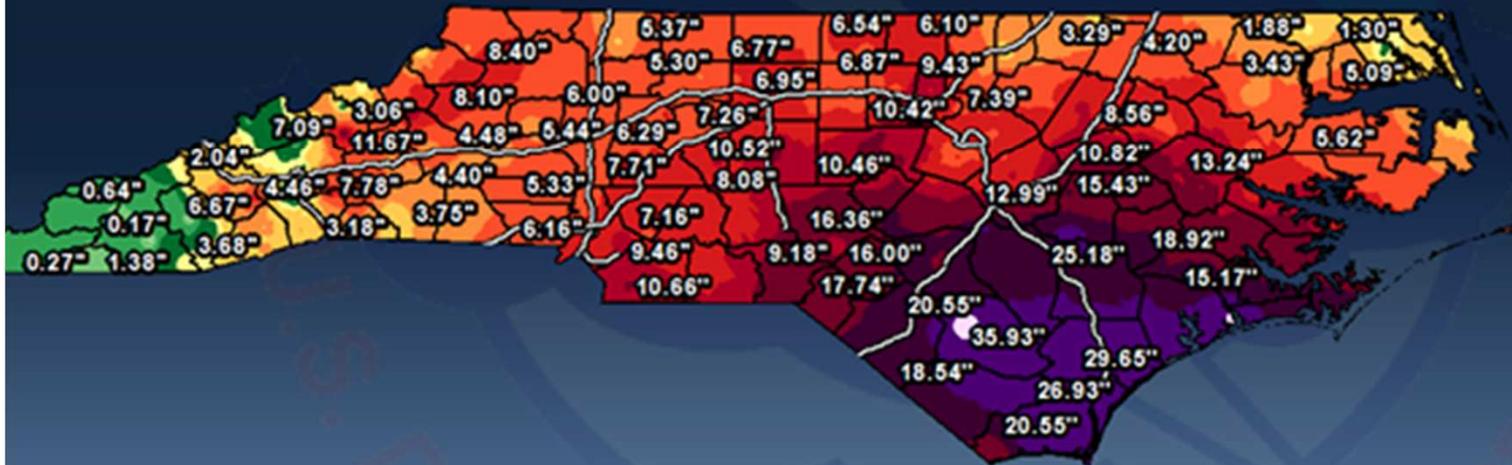
- Over 1,760 Incidents
- Over 2000 Identified FEMA Sites
- Over 700 Identified FHWA Sites
- Price tag of ~\$200 million



Hurricane Florence (September 2018)

National Weather Service Raleigh, North Carolina Preliminary Hurricane Florence Rainfall Totals

Data Source: Regional Observations(PNS)

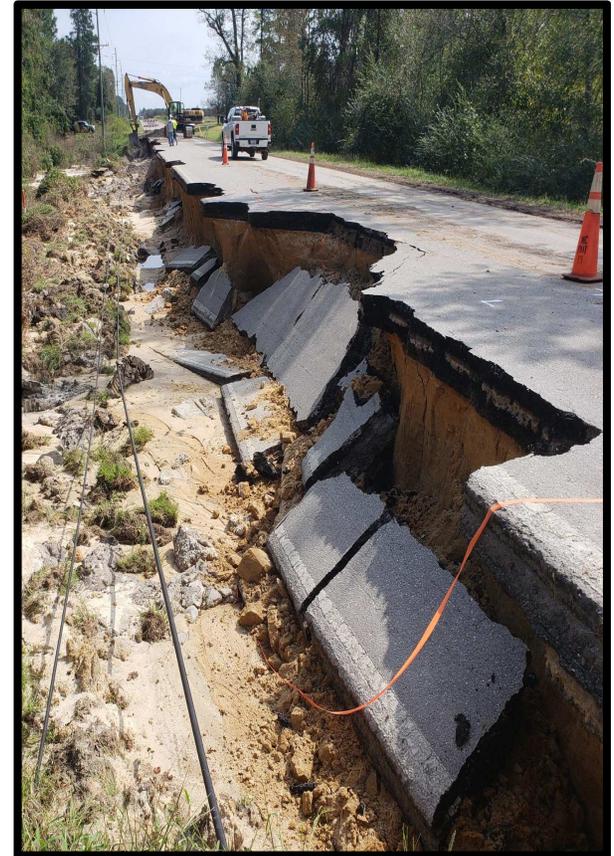
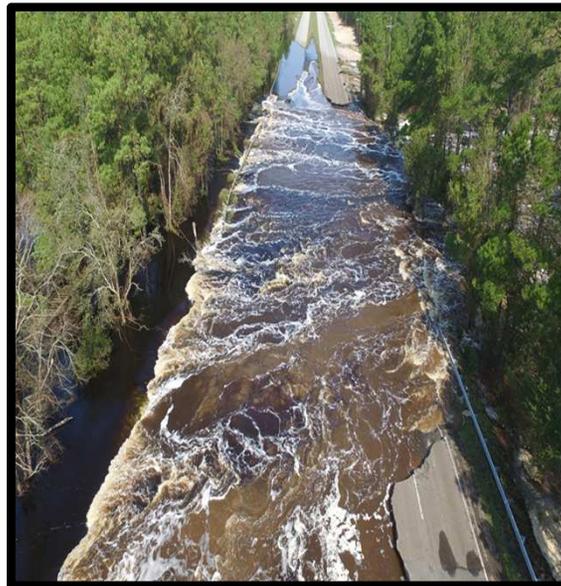


This is an experimental product. Care should be taken in using the data. Unofficial observations are plotted. Values at interpolated locations may not represent actual precipitation totals at that location.

Response and Recovery – Florence Damaged Sites



- Over 2,500 Incidents
- 2,642 Identified FEMA Sites
- 853 Identified FHWA Sites
- Price tag of ~\$210 million



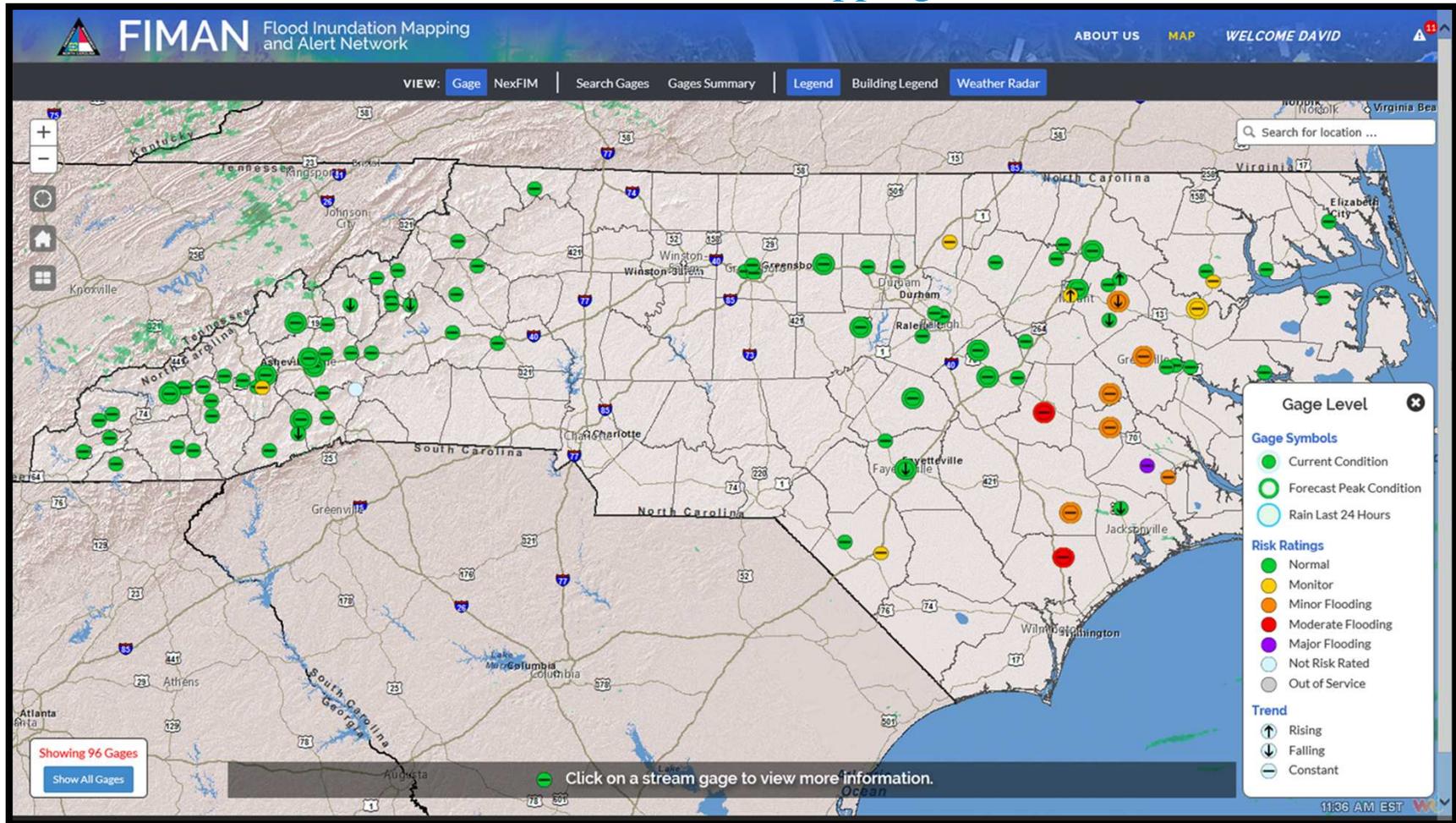
Response and Recovery

- Over 2,600 field personnel were deployed
- Over 2,100 pieces of equipment
- Nearly 10,000 barricades, detour signs, and high water signs
- Over 200 contractor crews



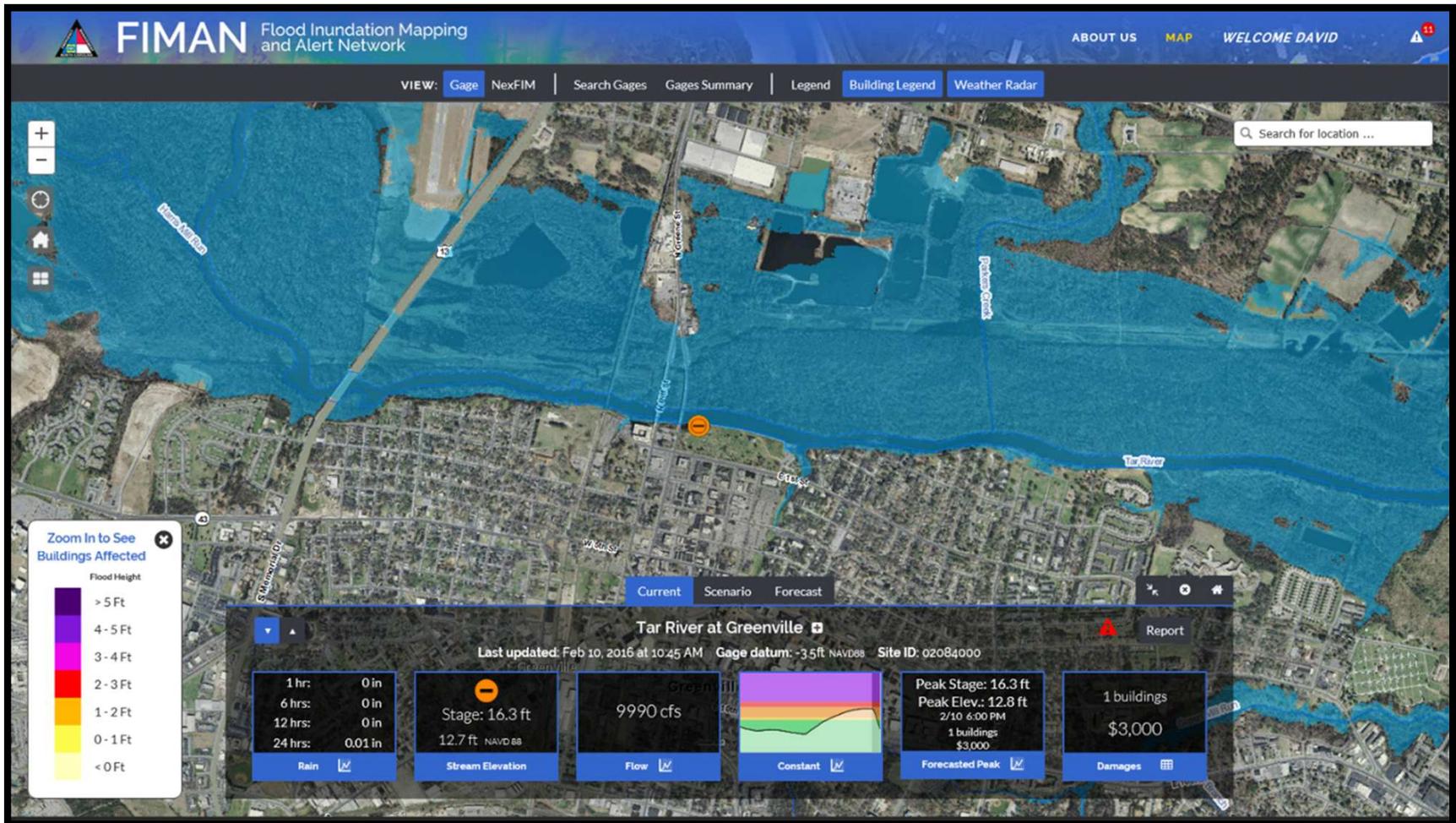
Response and Recovery

FIMAN – Flood Inundation Mapping Alert Network



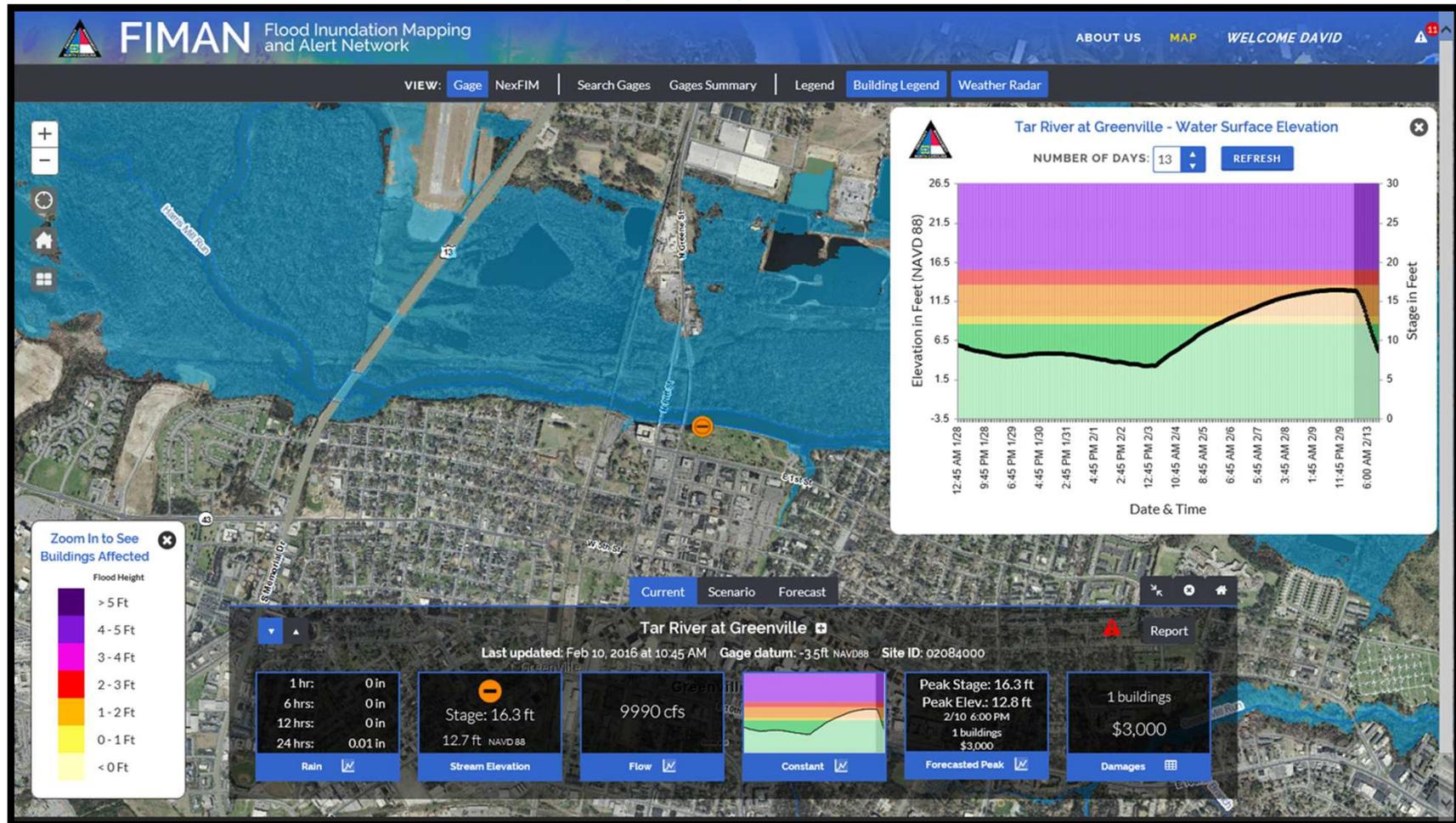
Response and Recovery

FIMAN – Current Inundation



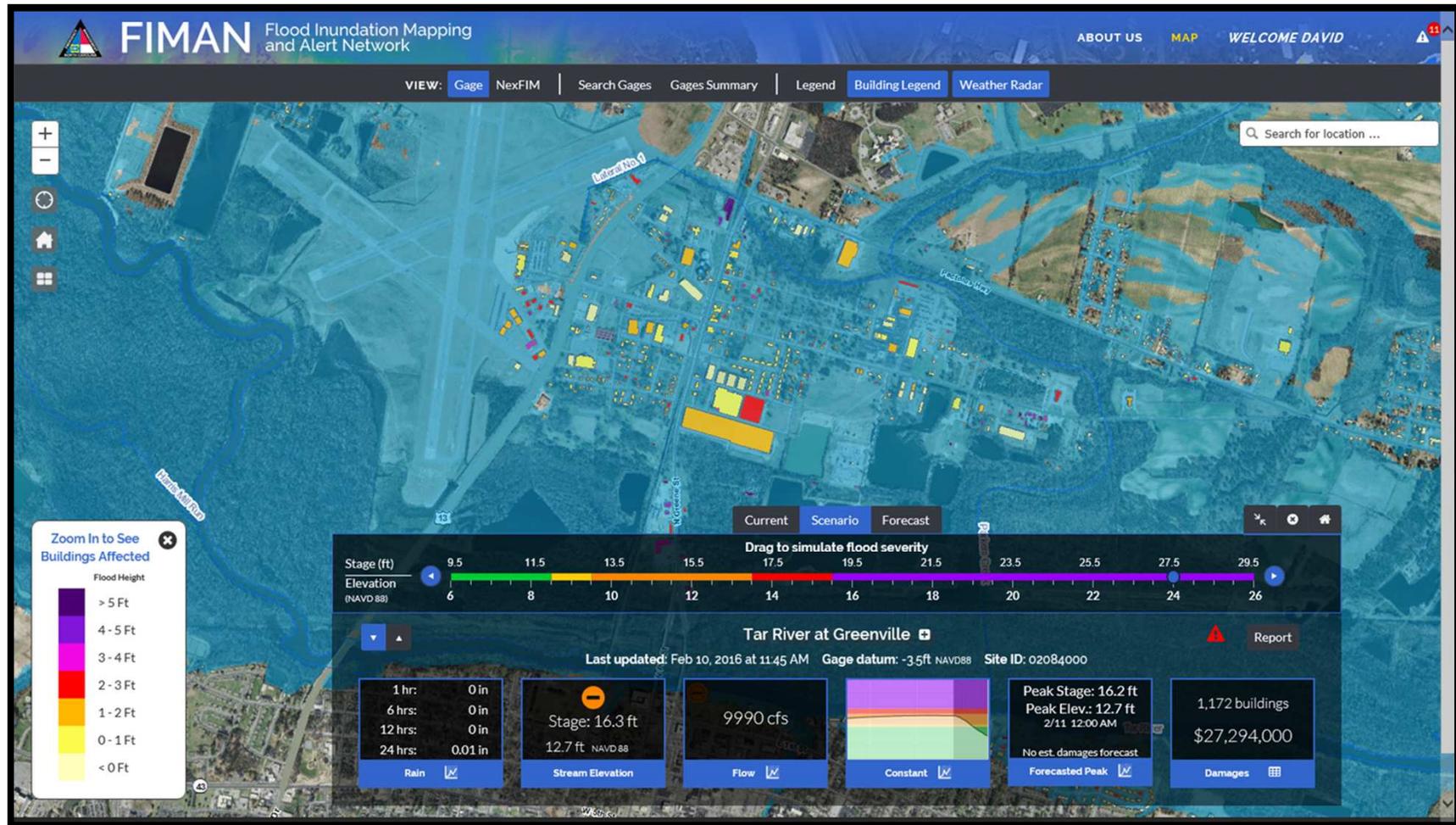
Response and Recovery

FIMAN – Gage Stage Charts & Forecast



Response and Recovery

FIMAN – Scenario



Response and Recovery

FIMAN – Beech Street Greenway (2-9-16. 11:45am)

FIMAN Flood Inundation Mapping and Alert Network

ABOUT US MAP WELCOME DAVID

VIEW: Gage NexFIM Search Gages Gages Summary Legend Building Legend Weather Radar

SEARCH BY: River Basin Gage Type Gage Name Gages Near Me

This Shadow is from roof of trail map board

Photo taken: 2/9/16 – 11:55 am

Tar River at Greenville

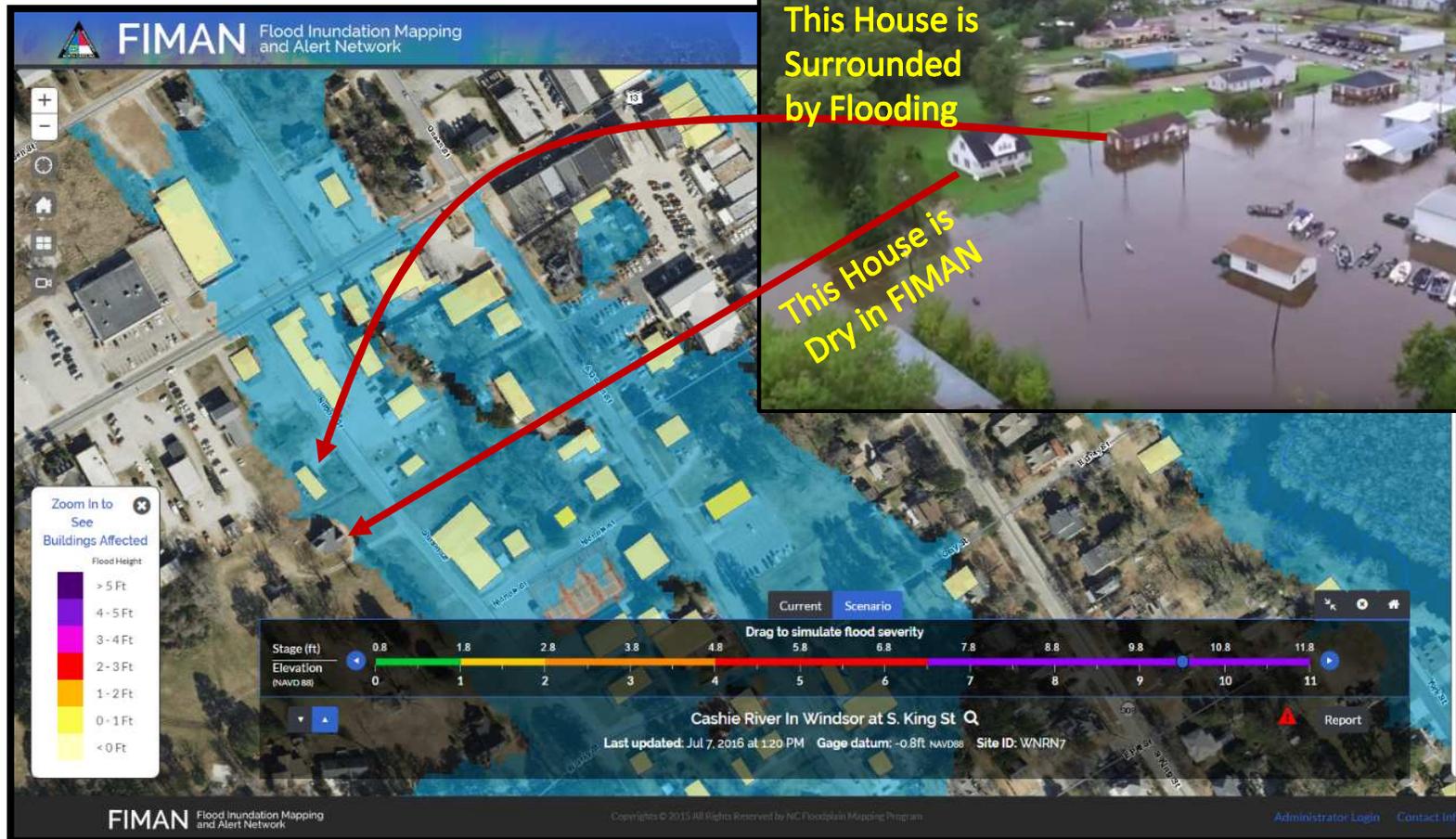
Last updated: Feb 9, 2016 at 11:45 AM Gage datum: -3.5ft NAVD88 Site ID: 02084000

1 hr: 0 in	Stage: 16.3 ft	9990 cfs	Constant	Peak Stage: 16.5 ft	1 buildings
6 hrs: 0 in	12.8 ft NAVD88			Peak Elev.: 13 ft	\$3,000
12 hrs: 0 in				2/10 12:00 AM	
24 hrs: 0.02 in				1 buildings	
Rain	Stream Elevation	Flow		Forecasted Peak	Damages

Showing 96 Gages Show All Gages

Response and Recovery

Windsor – Sept 2016



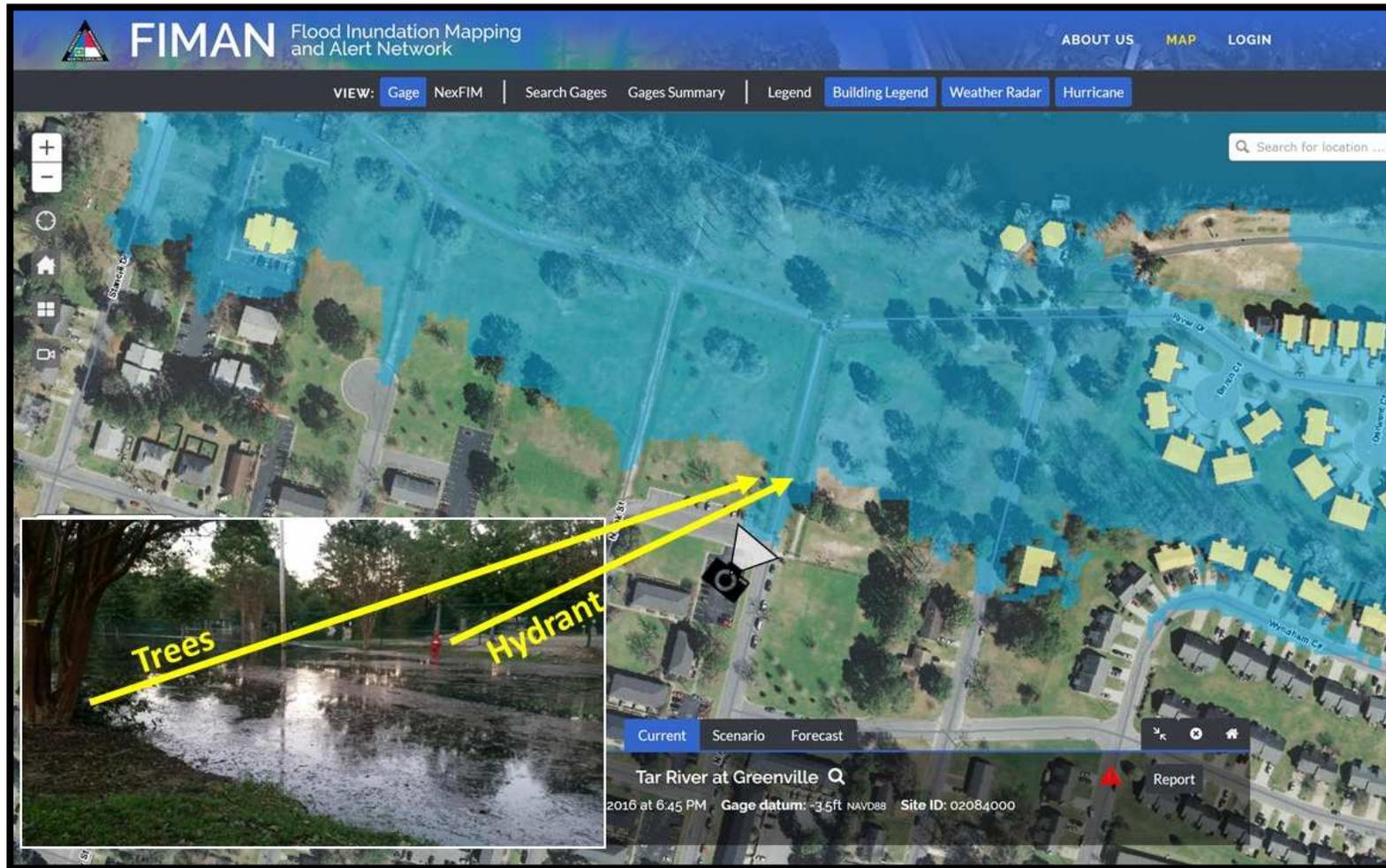
Response and Recovery

Windsor – Sept 2016



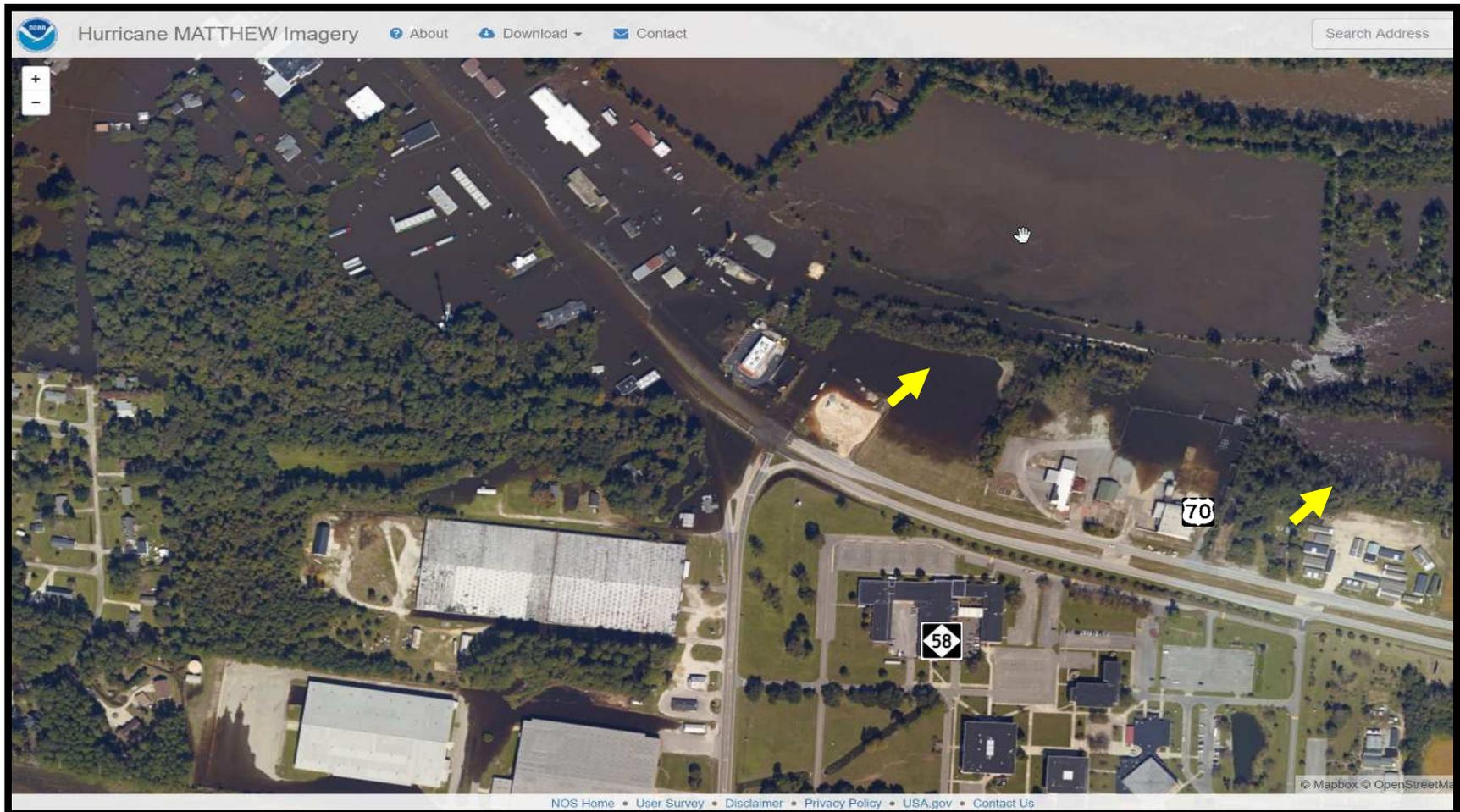
Response and Recovery

Greenville – October 11, 2016



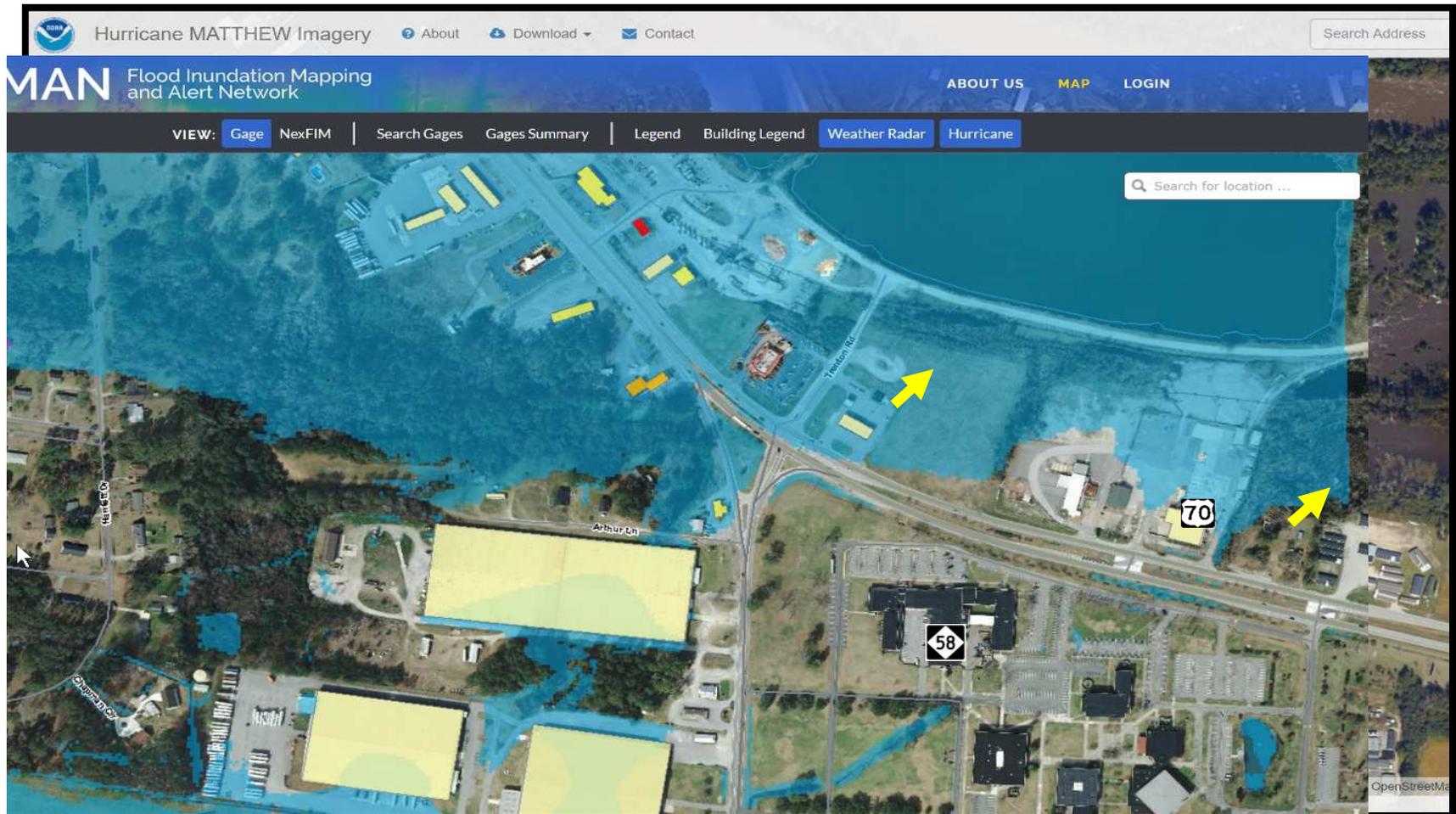
Response and Recovery

Kinston



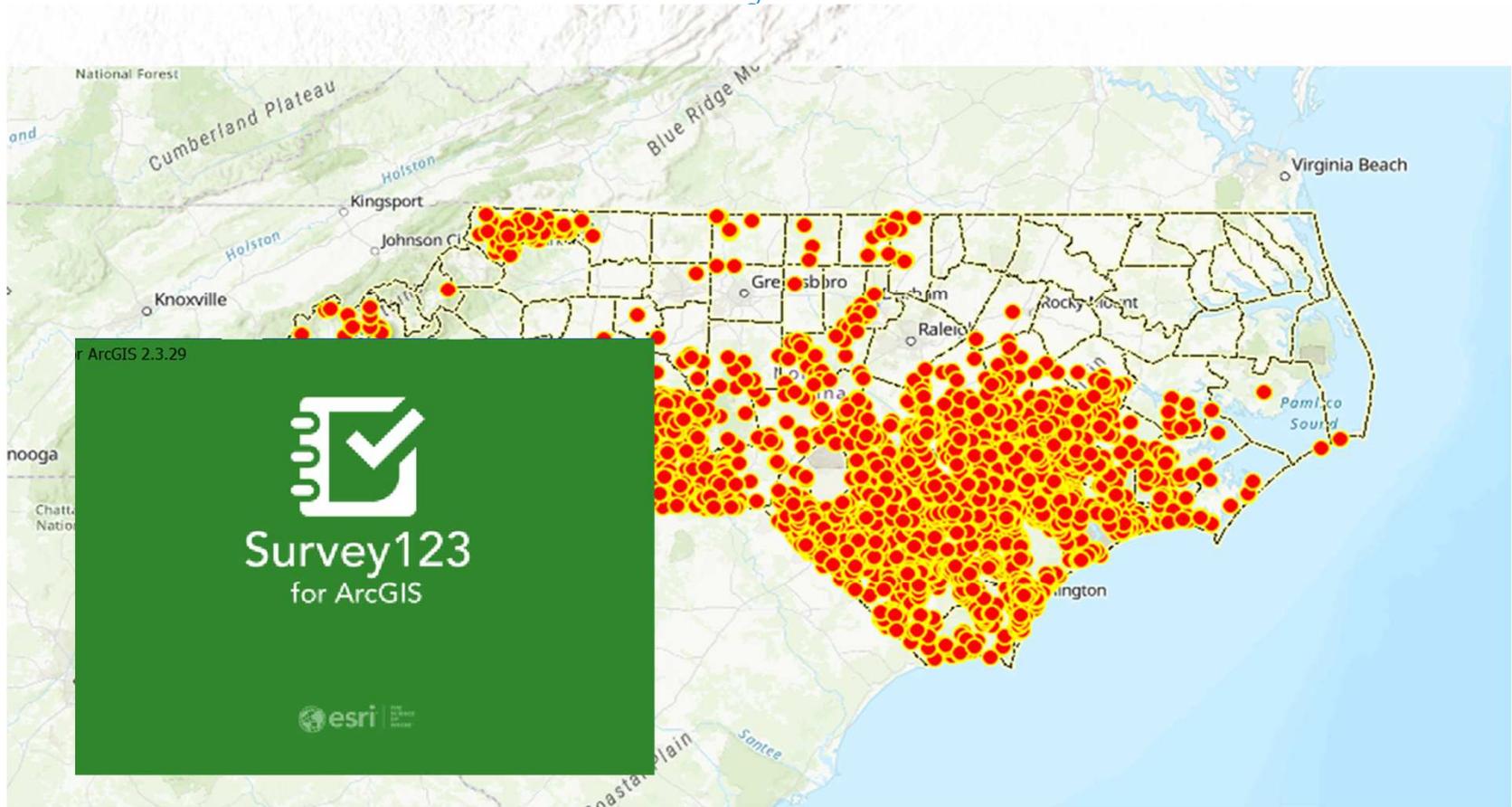
Response and Recovery

Kinston



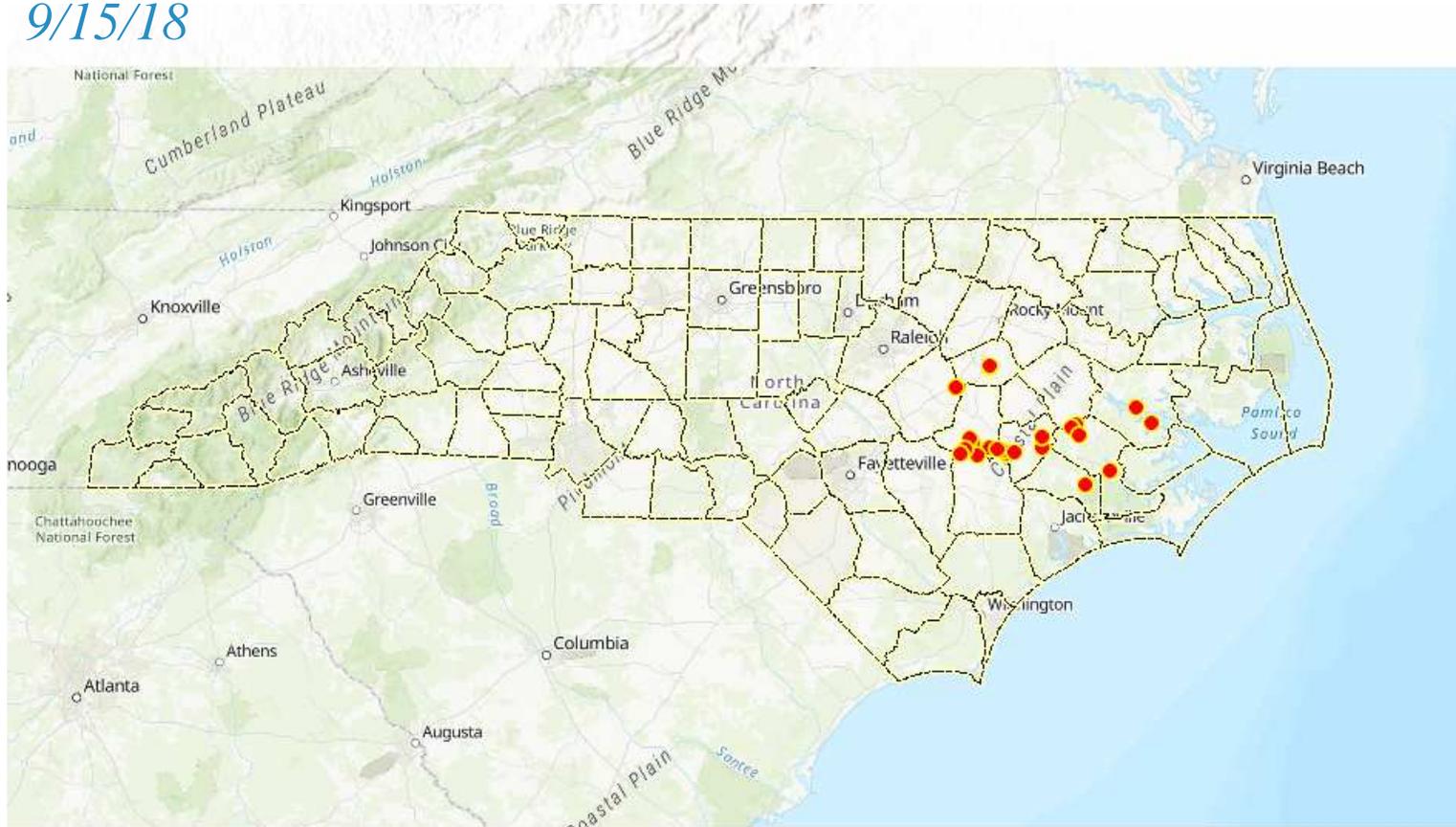
Response and Recovery

Survey123



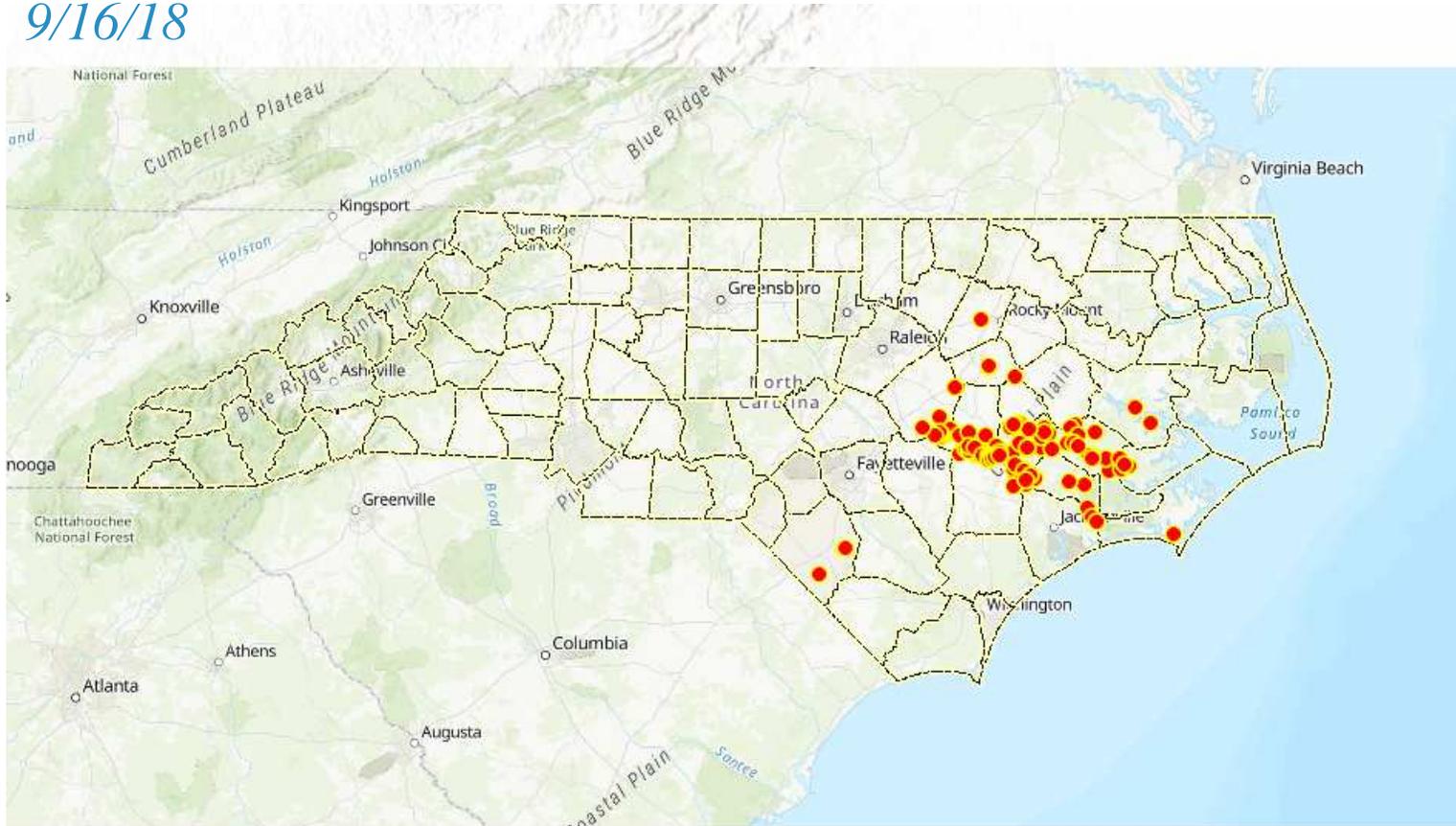
Response and Recovery

9/15/18



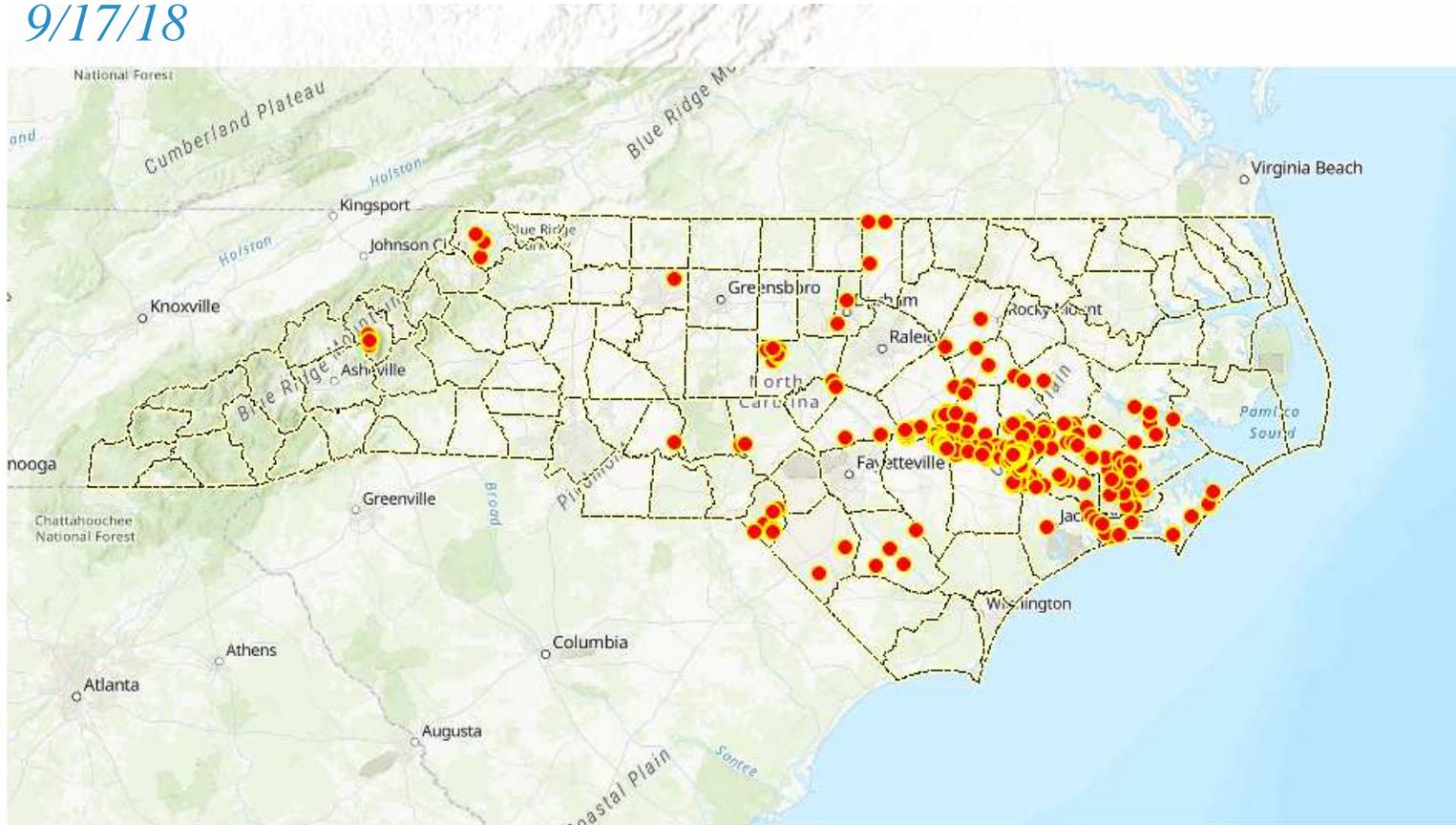
Response and Recovery

9/16/18



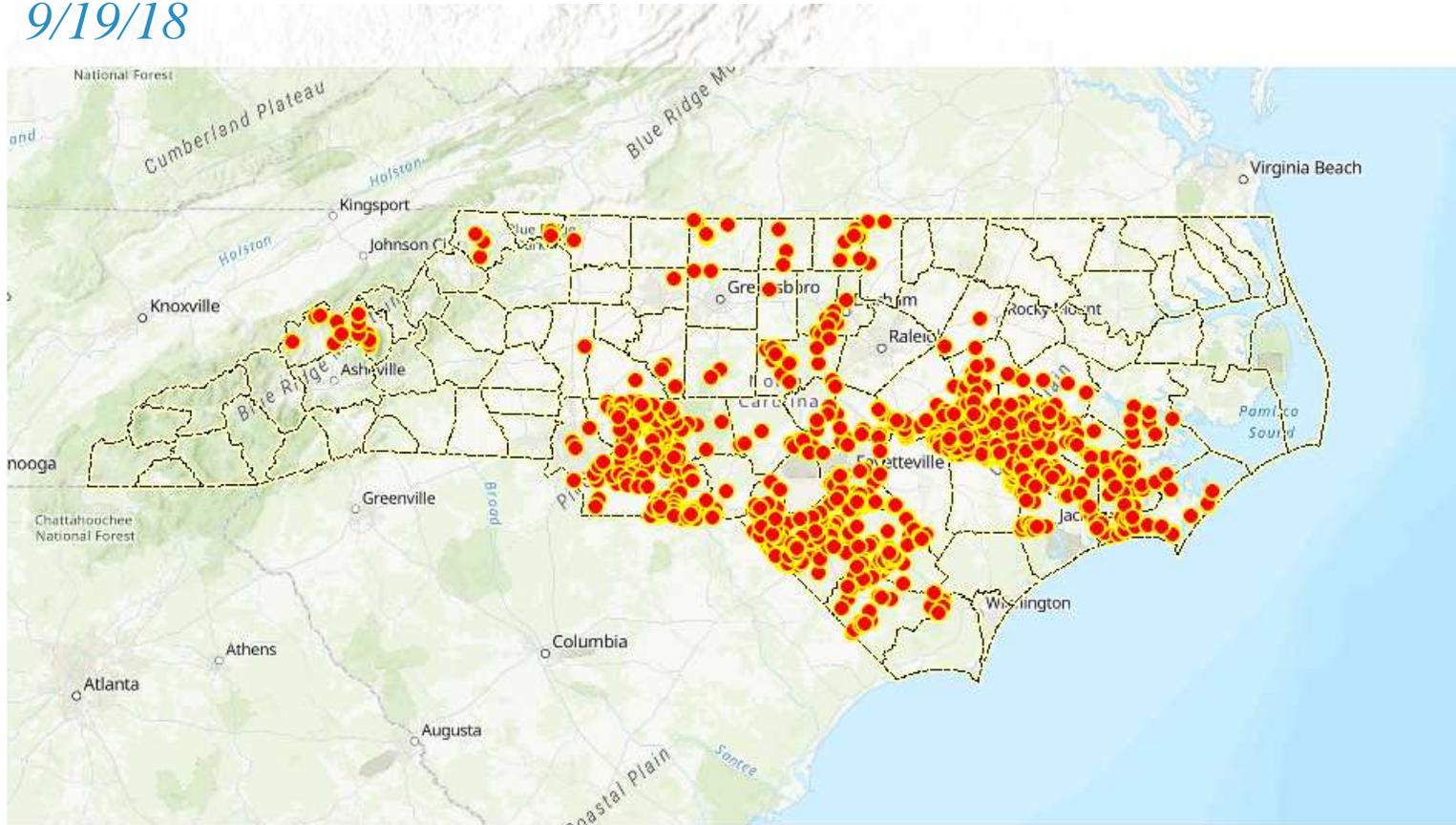
Response and Recovery

9/17/18



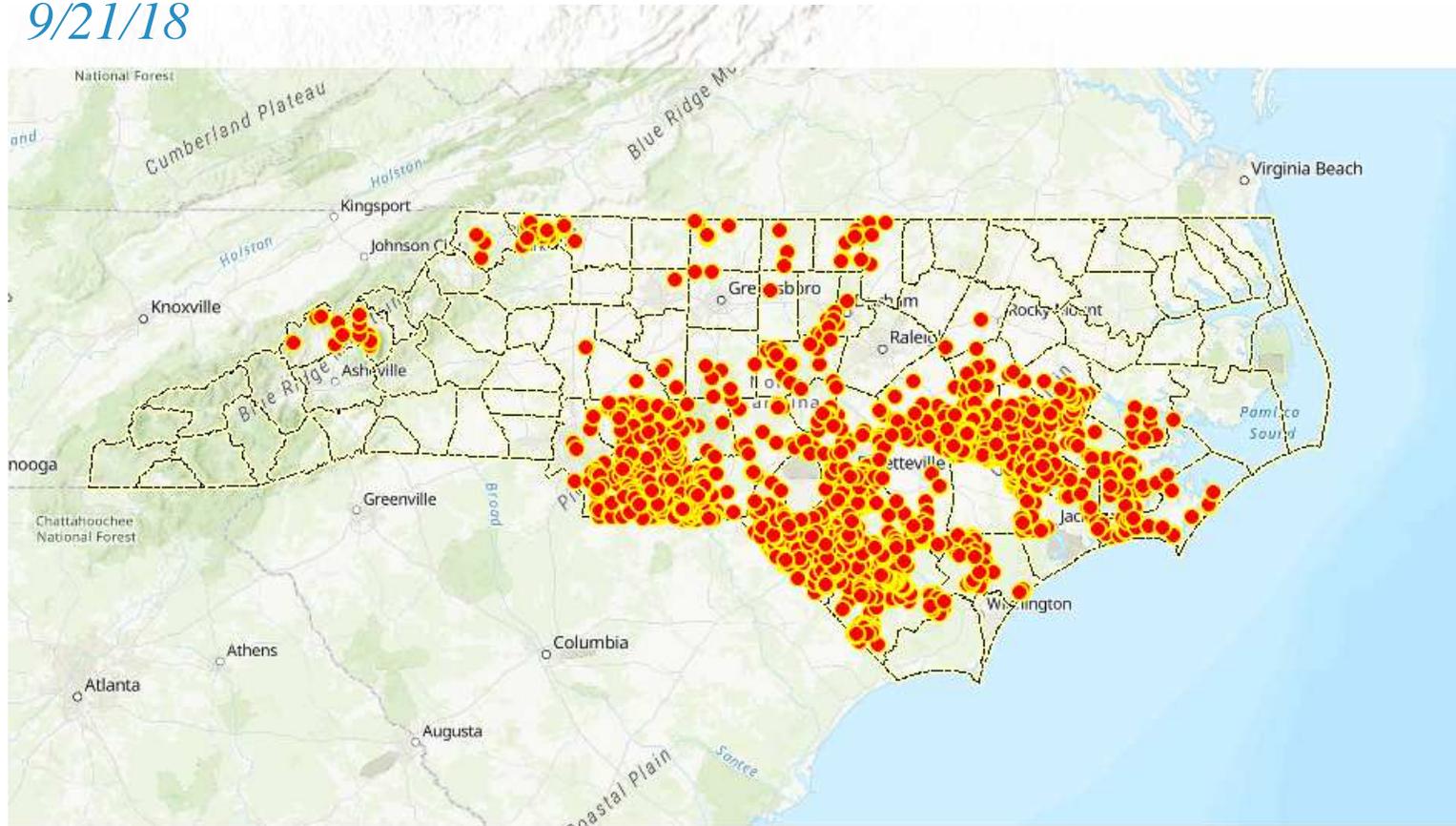
Response and Recovery

9/19/18



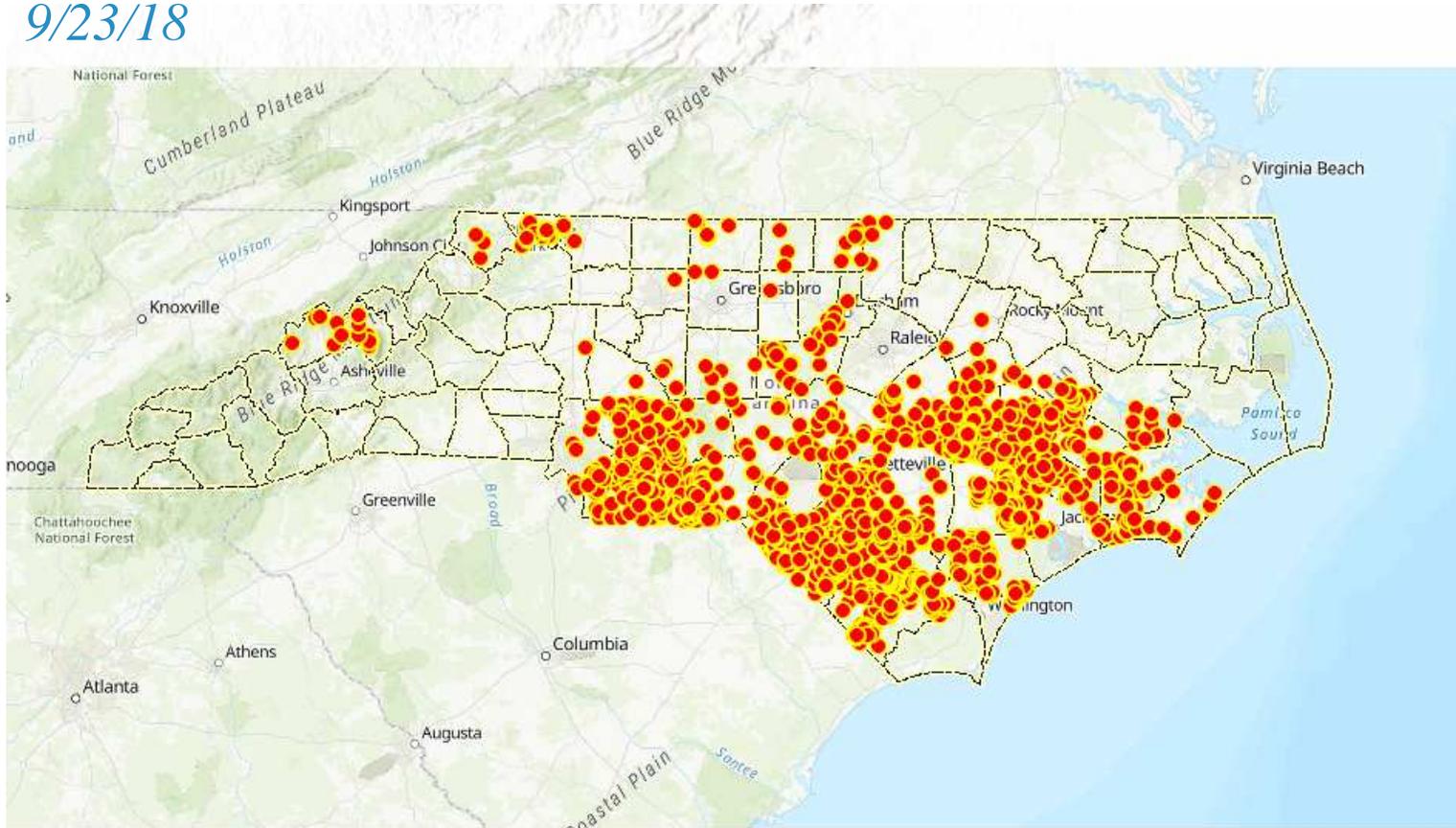
Response and Recovery

9/21/18



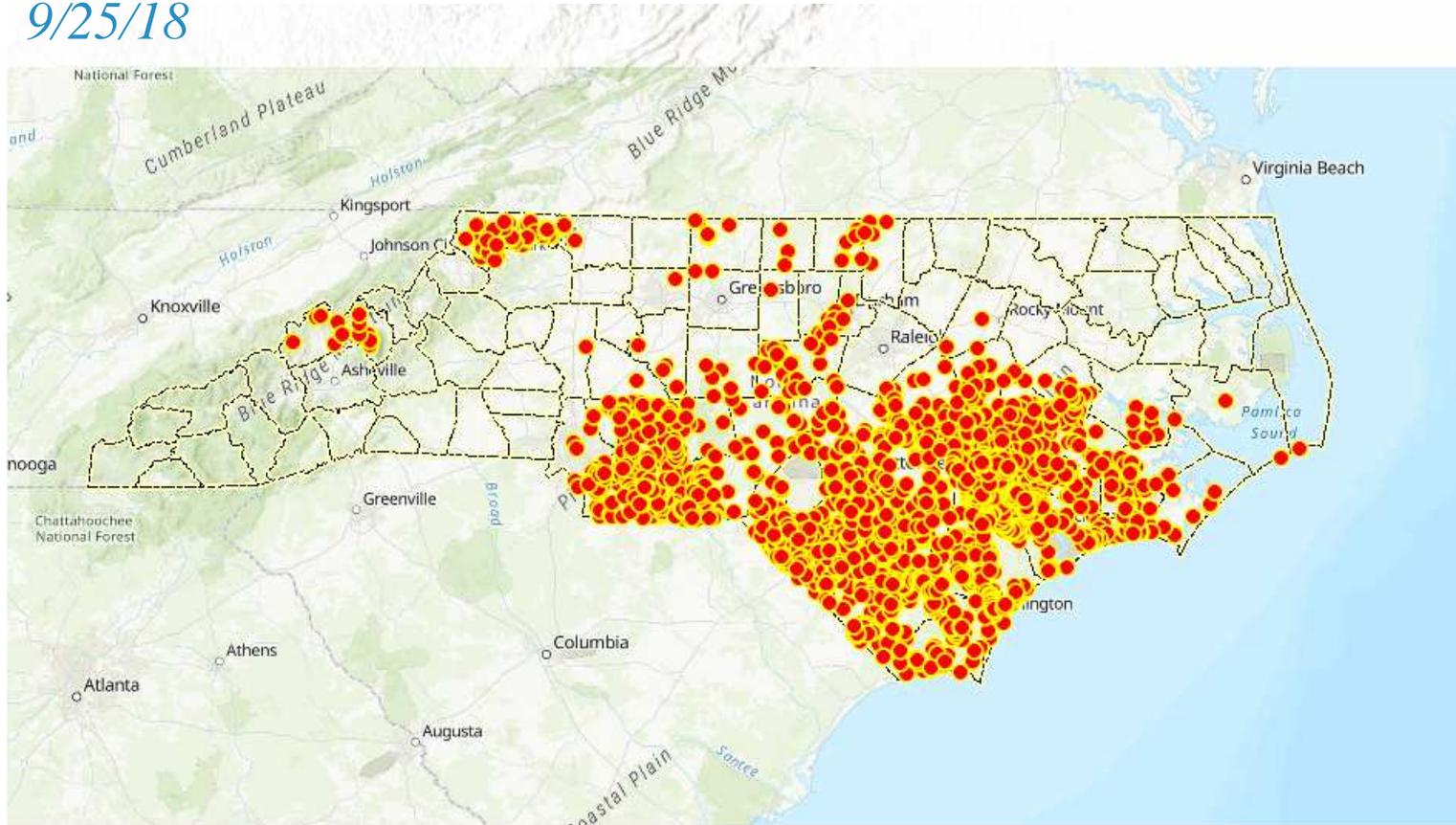
Response and Recovery

9/23/18



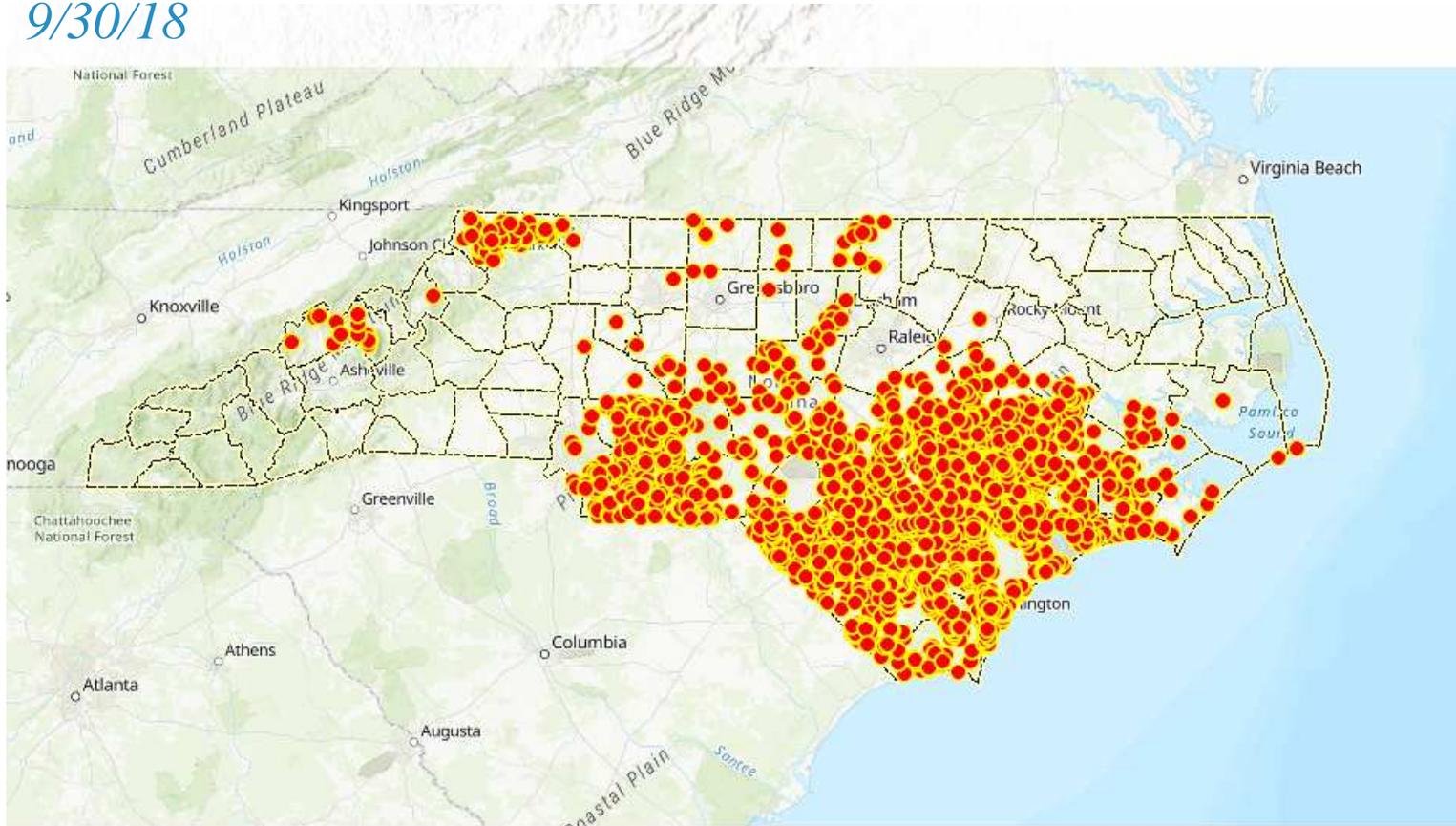
Response and Recovery

9/25/18



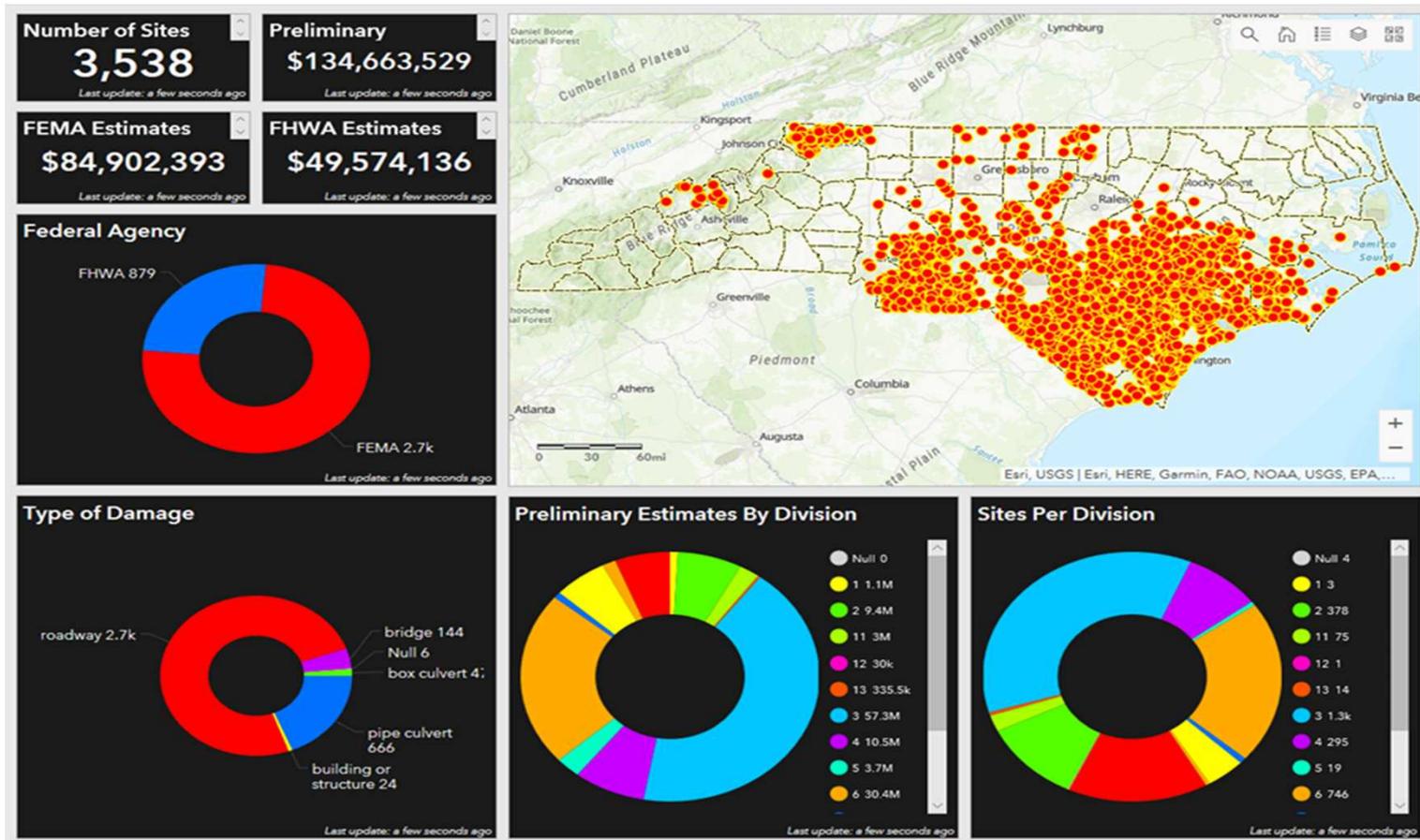
Response and Recovery

9/30/18



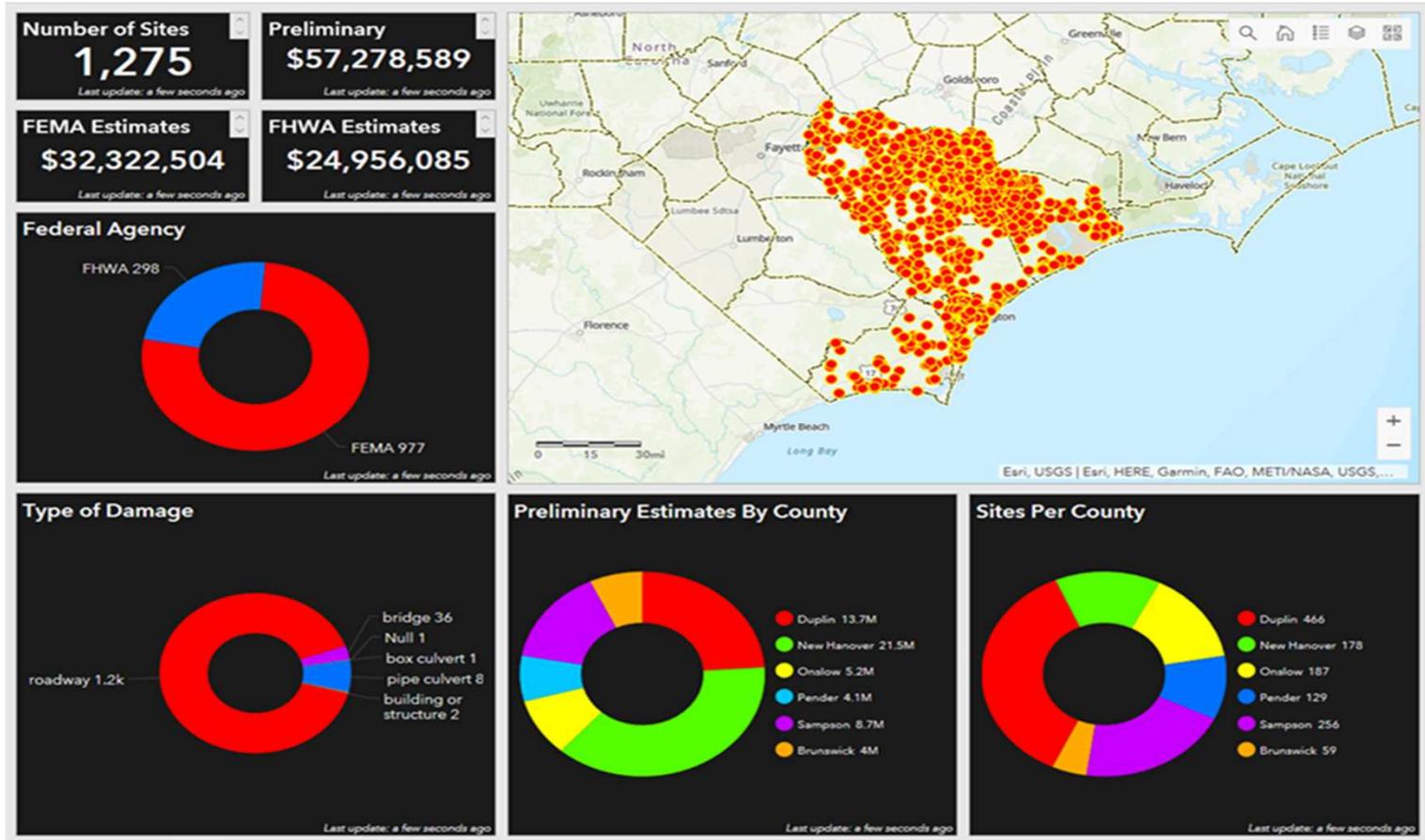
Response and Recovery

Statewide Summary



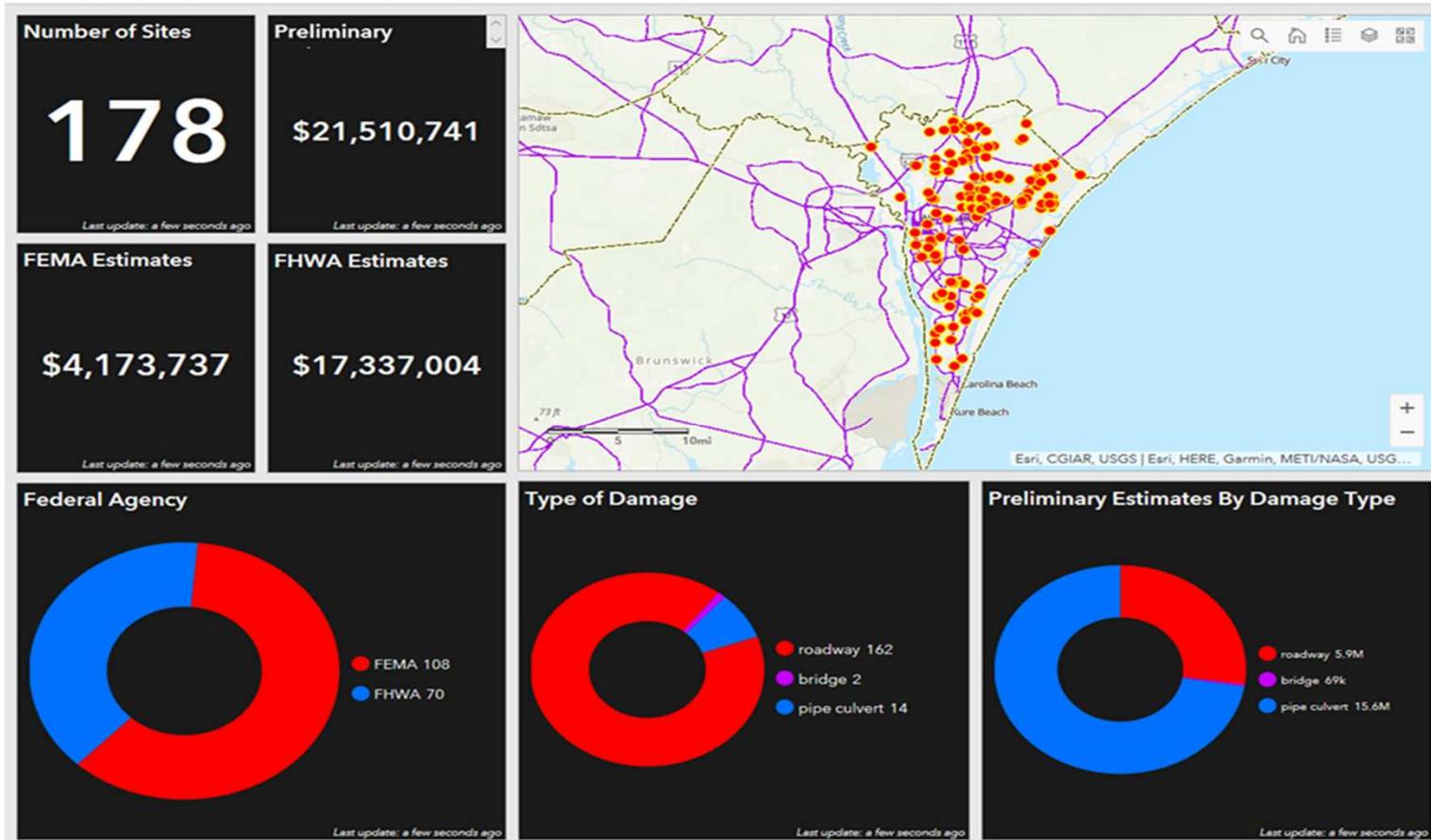
Response and Recovery

Division Summary



Response and Recovery

County Summary



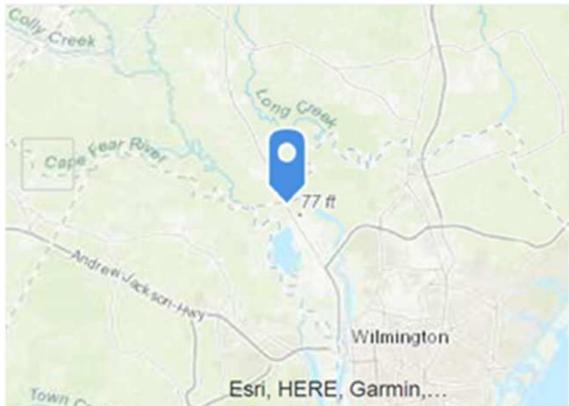
Response and Recovery

Site Detail Reports

Hurricane Florence Site Specific

Submitted By: gmtaylor1
Submitted Time: Sep 25, 2018, 4:03:51 PM
Date of Inspection: Sep 20, 2018
Name of Damage Inspector: D Monro
Phone Number of Damage Inspector: [REDACTED]

Site Number: 15403.1065027
Division: 3
County: New Hanover
Type of Route: US
Route Number: 421
Road Name: Hwy 421
Site Configuration: FHWA
Site Location: Lat: 34.33086 Lon: -77.99958



Type of Site Damaged: pipe culvert
Diameter of Pipe: 78
Length of Pipe: 210
Number of barrels: 1
Headwalls: No
Type of Pipe Damaged: CMP_corrugated metal pipe

Pavement Damage: Yes
Length of Pavement damaged: 600
Width of Pavement damaged: 56
Thickness of Pavement damaged: 12

Roadbed Damage: Yes
Length of Roadbed damaged: 700
Width of Roadbed damaged: 700
Depth of Roadbed damaged: 5

Shoulder/Embankment Damage: Yes
Length of Shoulder/Embankment damaged: 1,500
Width of Shoulder/Embankment damaged: 20
Depth of Shoulder/Embankment damaged: 20

Notes: Site 065-00-19 still has flow cannot fully assess at base, washed out. Pipe to be determined.

Signs and Guardrail: Yes
Length of Guardrail Damaged: 1,500
Number of Signs Damaged: 0

Utilites: Yes
Affected Utilities

- fiber
- gas

Damage Photo 1



Damage Photo 2



Preliminary Estimate: 15,000,000

Hydro Report: Yes

Response and Recovery

Drones



Recovery

- Codes and Standards
- FORE – Fully Operated Rental Equipment
- Communication



Questions

